

## COUNTRY: NEW ZEALAND

Annual Report on national involvement in SCAR activities in year:

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<b>SCIENTIFIC HIGHLIGHTS / DELIVERABLES (with reference or contact details):</b>						

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**Marine Biodiversity and Ecosystems:**

**Overview:** A strong and diverse marine programme is made up of 6 projects. These aim to: test the hypothesis that different fish have different abilities to acclimatise to increases in water temperature, and look at the influence of habitat on that acclimation; increase our knowledge of how lipid transport and metabolism systems work in notothenioid fish and to determine whether this lipid transport system is related to cold adaptation; study the distribution and abundance of meroplankton (larvae of benthic marine invertebrates and fish) in the water column by using morphological and molecular approaches to identify common larval types; study the productivity of algae that live in and under the sea ice and determine what the effects of global climate change will have on this productivity (NZ-funded IPY project); determine increased UV-R radiation damages the DNA of Antarctic invertebrate larvae and embryos and the impacts on how they recover from such damage, and the effects of ocean acidification on the development the invertebrate's skeleton. The final project is a long-term study aimed at characterising the structure and function of benthic marine communities and determine their relationships to key environmental factors as this is important for an improved understanding of Antarctic biodiversity and ecology, and management of the Antarctic coastal zone (NZ-funded IPY project).

***Individual projects***

- K018: Studying the distribution and abundance of meroplankton (larvae of benthic marine invertebrates and fish) in the water column. Uses morphological and molecular approaches to identify common larval types. Contributes to the LGP.
- K043: Studying the productivity of algae that live in and under the sea ice. Determine what the effects of global climate change will have on this productivity (important because sea ice covers a large area). Contributes to the LGP and is a NZ-funded IPY project.
- K057: Temperature Change and Cardiovascular Physiology of Antarctic Fish. Testing the hypothesis that different fish have different abilities to acclimatise to increases in water temperature, and looking at the influence of habitat on that acclimation.
- K058: Unique Fat Transport in Antarctic Fish – Cold Adaptation? Aimed at increasing our knowledge of how lipid (fat) transport and metabolism systems work in notothenioid fish and to determine whether this lipid transport system is related to cold adaptation. (CCC Scholarship)
- K068: Looking at how increased UV-R radiation damages the DNA of Antarctic invertebrate larvae and embryos and the impacts on how they recover from such

damage. Also looking at the effects of ocean acidification on the development the invertebrate's skeleton.

K082: Long-term project aimed at characterising the structure and function of benthic marine communities and determine their relationships to key environmental factors. Important for an improved understanding of Antarctic biodiversity and ecology, and management of the Antarctic coastal zone. Contributes to the LGP and is a NZ-funded IPY project.

## **Terrestrial Biodiversity and Ecosystems**

**Overview:** In the Biodiversity arena, four projects are aimed at: using modern molecular phylogenetic methods to study the distribution of micro-organisms in Antarctic soil, understanding the key environmental factors that dictate this distribution, and determining the role in the community structure that these micro-organisms play; studying the biodiversity and performance of lichens, mosses, springtails, mites and nematodes along the Victoria Land coast; understanding the mechanisms of cold adaptation and proliferation of life in extreme environments, and identifying causes of deterioration of historic huts and artifacts; using an interdisciplinary approach to determine the present status of Dry Valley biodiversity, and to predict the effects of multiple potential impacts on these ecosystems (NZ-funded IPY project).

Four projects fall under “Ecosystem Functioning” Undertake a long-term study on the population dynamics of the Adèlie penguin population of the Ross Sea as a biological indicator of local, regional and global change; study the polar evolution of springtails by looking at growth rates, responses of the metabolic rate to temperature and the connection between activity, growth and evolutionary rates; study physiological adaptations of nematodes to Antarctic conditions including their tolerance to freezing; study various aspects of Antarctic aquatic ecosystems, geochemistry of ponds, and photosynthetic and nitrogen fixation rates of microbial mats to assess model predictions against actual observations including the first season of observation through to April when biological processes are slowing down (NZ-funded IPY project).

### ***Individual projects:***

#### **a. Terrestrial Biodiversity**

K021 Ecosystem Functioning of Terrestrial Microorganisms is trying to understand mechanisms of cold adaptation and proliferation of life in extreme environments, and identify causes of deterioration of historic huts and artifacts. Contributes to the LGP.

K023: Microbial Biodiversity of the Ross Desert. Uses modern molecular phylogenetic methods to study the distribution of micro-organisms in Antarctic soil (that were previously thought not to exist), understand the key environmental factors that dictate this distribution, and determine the role in community structure that these micro-organisms play.

K024: Studying the biodiversity and performance of lichens, mosses, springtails, mites and nematodes along the Victoria Land coast. Contributes to the LGP. (HNZ PhD Scholarship)

K024D: This Terrestrial Biocomplexity project is using an interdisciplinary approach to determine the present status of the biodiversity, and to predict the effects of multiple potential impacts on these ecosystems. The main goal of the research will be a dynamic geographic information system in which the specific observations about patterns and processes of the physical environment, plus observations of the presence of particular organisms and their interactions, will be mapped and linked with computer models that allow prediction into as-yet



unsampled locations and scenarios for future change in conditions. Contributes to the LGP and is a NZ-funded IPY project.

#### **b. Ecosystem Functioning**

- K025: Studying the polar evolution of springtails by looking at growth rates, responses of the metabolic rate to temperature and the connection between activity, growth and evolutionary rates. Linked with work in the Subantarctics and the Peninsula. (Sir Robin Irvine PhD Scholarship)
- K066: Diversity and Survival Strategies of Nematodes. Studying physiological adaptations of nematodes to Antarctic conditions including their tolerance to freezing.
- K081: Studying various aspects of Antarctic aquatic ecosystems, geochemistry of ponds, photosynthetic and nitrogen fixation rates of microbial mats to assess model predictions against actual observations. Includes the first season of observation through to April when biological processes are slowing down. Contributes to the LGP and is a NZ-funded IPY project.
- K122: Long-term study on the population dynamics of the Adelie penguin population of the Ross Sea as a biological indicator of local, regional and global change. Contributes to the LGP.

#### **Management and Conservation:**

**Overview:** Research supports environmental protection and management of ice-free areas of the Ross Sea region by increasing the fundamental knowledge and understanding of Antarctic soils including soil distribution and climate, and vulnerability to human impact.

##### **Individual Projects:**

- K123: Research to support environmental protection and management of ice-free areas of the Ross Sea region by increasing the fundamental knowledge and understanding of Antarctic soils including soil distribution and climate, and vulnerability to human impact. Contributes to the LGP.

#### **Human Ecology:**

**Overview:** Research supports beneficial interaction between human beings and the natural environment through increased understanding of the links between human physiological and psychological processes in the polar regions.

##### **Individual Projects:**

- K073: Environmental ethics and decision-making. This project examines the relationships between environmental values, decision-making processes, and the social networks of field and base personnel.

The current science strategy document plus further information on these projects (including web links to the project home pages, recent publications and metadata) can be found on Antarctica New Zealand's website at: [www.antarcticanz.govt.nz](http://www.antarcticanz.govt.nz). Also on New Zealand's IPY website: <http://ipy.antarcticanz.govt.nz/>

## New Zealand Report to SCAR GeoSciences Standing Scientific Group (SSG-GS), St Petersburg, Russia, July 2008.

### Recent activities in New Zealand's Geoscience Research

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#### Overview

New Zealand supported six Geoscience projects during the 07-08 Antarctic season. Our main project was the ANDRILL drilling project where two holes were drilled in collaboration with USA, Italy and Germany; the McMurdo Ice Shelf hole in 2006 and the Southern McMurdo Sound hole in 2007. The drilling programmes were very successful with an extremely high core recovery resulting in an excellent sedimentary record from the present day to the base of the Miocene. As well as the above mentioned drilling programme, New Zealand continued to support Geoscience projects on Gondwana including Palaeozoic tectonics and the Ferrar Large igneous province. New Zealand also has an interest in Antarctic soils and has developed a new capability of cosmogenic dating. Samples were collected from glacial moraines within the Darwin-Hatherton glaciers in the Transantarctic Mountains as part of a New Zealand lead Latitudinal Gradient Project.

#### Individual projects

- K001: ANDRILL – Antarctic Drilling Project.** The Southern McMurdo Sound project (SMS) drilled 1138.54m of marine sediment under the sea ice of the Southern McMurdo Sound. This sediment records the history of climate and glacial fluctuations in Antarctica over the past 20 million years.
- K051: Palaeozoic tectonics of the Gondwana margin.** Studied various aspects of the geology of Victoria Land to answer questions about how the area developed when it split from the Super Continent Gondwana, hundreds of millions of years ago.
- K056: Dynamics and Change of the Darwin-Hatherton Glacial System.** Studying the response of the Antarctic ice sheet to future climate change. Combines glacial, geomorphological and climatological approaches. Contributes to the Latitudinal Gradient Project.
- K061: Magma Supply Dynamics of the Ferrar Large Igneous Province.** Aims to determine how liquid lava reached the surface to feed massive basaltic lava flows of the Ferrar large igneous province at Pandora Spyre and Terra Cotta Mountain 180 million years ago.
- K102: Scott Base magnetic observatory.** Continuous recordings of the earth's magnetic field from 1957. Seismological and Geomagnetic observations.

**K123: Environmental protection of Antarctic soils.** Research to support environmental protection and management of ice-free areas of the Ross Sea region by increasing the fundamental knowledge and understanding of Antarctic soils including soil distribution and climate, and vulnerability to human impact. Contributes to the Latitudinal Gradient Project.

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- K049: ITASE – Holocene Variability along the Victoria Land Coast. NZ portion of the international project ITASE aimed at collecting and analysing ice cores to determine the spatial climate variability across Antarctica over the last 200 years. This project focuses on coastal cores which have been shown to be very sensitive to climatic variability. (New Zealand Post Scholarship)
- K064: Thermal and mechanical processes beneath cold ice. Aims to characterise the composition of ice beneath glaciers to help understand how glaciers move.
- K131: Long-term study on sea ice and Southern Ocean processes. Looking at the physical oceanography of McMurdo Sound, the turbulence that exists under sea ice and its influence on ice formation, circulation in Antarctic fjords, and the physical processes involved in the formation of frazil ice beneath land-fast sea ice. NZ-funded IPY project. (Kelly Tarlton's Scholarship)
- K055: Dynamics and Ionisation in the Antarctic Middle Atmosphere. Long-term study on the general circulation of the atmosphere, in particular, the behaviour of wave-driven circulation in the middle atmosphere and how this effects the transport of energy and momentum to higher altitudes.
- K069: Long-term project monitoring magnetosphere-ionosphere coupling and space weather at high latitudes. Has applications for communications predictions and plasma physics.
- K084: Studies the role of Bromine oxide in the regular depletion of tropospheric ozone during the Antarctic springtime. Helps us understand how these processes might influence the global tropospheric chemistry, which is important for the changing concentrations of greenhouse gases.
- K085: Long-term research programme targeted at understanding the drivers of change in the atmosphere, particularly those involved in the formation of the Antarctic ozone hole.
- K087: Looking at human-induced long-term trends in trace gases to determine changes in oxidative capacity of the atmosphere.
- K089: Collection of a continuous Scott Base climate record from 1957.

- K042: Long-Term monitoring of tides at Cape Roberts and at Scott Base.
- K123: Research to support environmental protection and management of ice-free areas of the Ross Sea region by increasing the fundamental knowledge and understanding of Antarctic soils including soil distribution and climate, and vulnerability to human impact. Contributes to the LGP.